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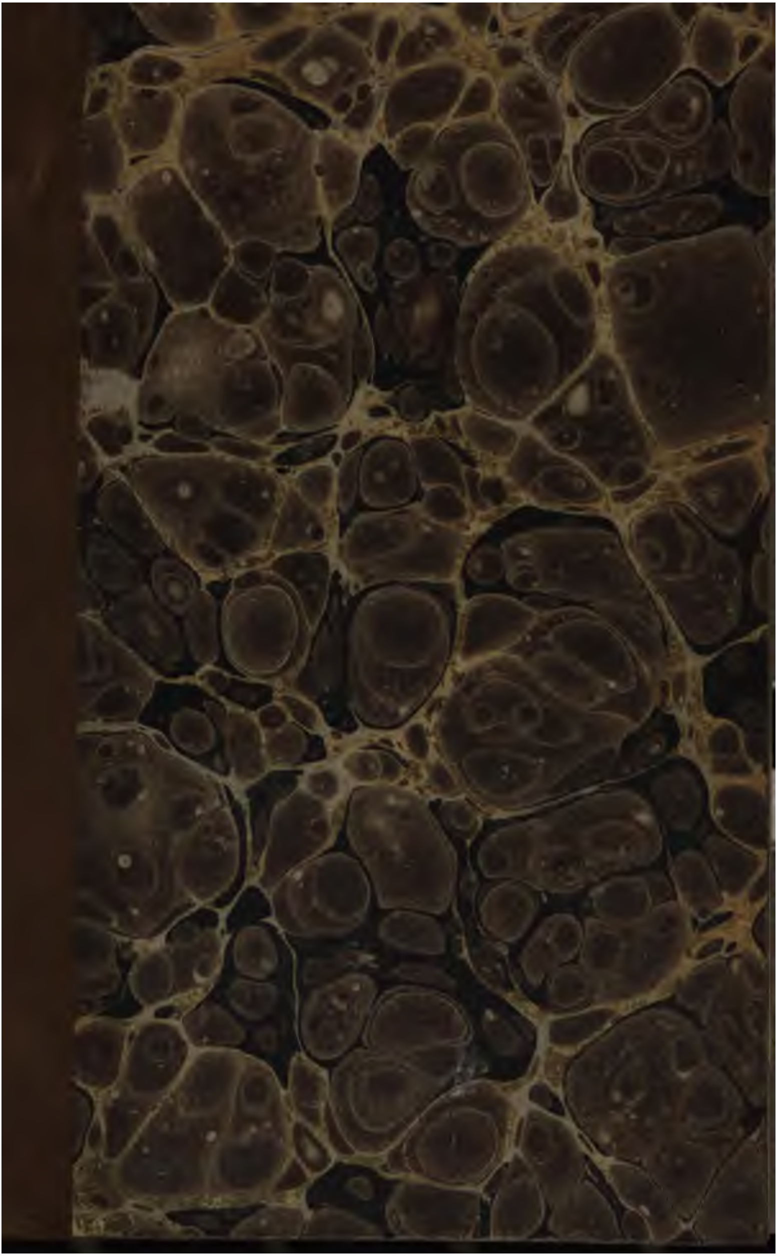

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# THE FOOT OF THE HORSE;

ITS

## STRUCTURE AND FUNCTIONS:

WITH

THE MEANS OF PRESERVING ITS HEALTHY ACTION,

AND OF

REMEDYING ITS DISEASES,

BY

## A NEW METHOD OF SHOEING.

BY

THOMAS CLARENDON,

AUTHOR OF "AN ESSAY ON THE POWERS OF THE HORSE, ETC."

93

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# AN ESSAY,

## &c. &c.

### INTRODUCTION.

§ 1. HAVING, in a separate work, investigated the best means of developing the powers of the Horse, by a system of training, and of preserving the animal in his most efficient state, by proper methods of riding, driving, and harnessing, I have still, in order to complete the inquiry into the best means of adapting the powers of the animal to the uses of man, in their most efficient condition of draught and burthen, to inquire into another highly important arrangement necessary to the completion of the horse's full equipment for our use, namely, into the best method of SHOEING.

§ 2. To protect the delicate structure of the foot, which nature has only formed of materials strong enough to bear the resistance of the soft natural turf, against the wear and tear of our artificial roads and pavements, and the shocks and collisions incident to crossing a country, is the duty of the shoer; and this he can only do by attaching some foreign substance to the natural hoof, the thick walls of which seem to invite the nailing on of a plate of metal, which appears to have been agreed on by common consent as the most available succedaneum.

Accordingly, we find in all civilized countries, from the earliest times, the use of the metal shoe attached to the exterior crust of the hoof by nails driven in round its circumference; the metal, in some instances, being a broad plate covering the entire sole; in others, having a small aperture in the middle; and again, as among the principal European nations, being a bent bar or circlet of iron, open behind, and of more or less breadth, according to the work in which the animal might be engaged. Such have been the usual means devised by human ingenuity to defend the foot of the horse against external injury, and in which iron, copper, brass, and even silver, have been at various times employed; other defences of leather, of wood, and of mixed metal and caoutchouc, have also been devised for the remedy or alleviation of particular diseases; but, generally, the business of the horse-shoer is to apply a band of the metal which most unites the qualities of hardness and toughness, that is, iron, by such attachments as shall afford security, without impeding action; and this is the problem which I now propose for my investigation.

§ 3. In order to conduct the inquiry in a satisfactory manner, it becomes important to consider, first, the form and functions of the foot, which it is the business of the shoer to defend, and which a perfect shoe ought to defend, with the least possible interference with these functions; secondly, the evils arising from such interference; and finally, the mode of shoeing which shall, while it affords the due protection, cause the least amount of such interference.

# CHAPTER I.

## STRUCTURE AND FUNCTIONS OF THE FOOT.

§ 4. In the Essay on Training above alluded to, I have shewn, that the hind-legs of the horse are the proper instruments of propulsion, and that the fore-legs are designed by nature only to sustain the weight of the fore-parts during the successive efforts of the propellers from behind. I have also shewn, that the imposition of weight in the place usually adopted for burthen, without making any adequate compensation for the shifting of the natural centre of gravity, casts an undue labour on the fore-legs, which are thus forced to assume, to some extent, the office of propellers, and in so doing become subject to various diseases; while the hind-feet, having now less to do than they ought properly be called on to perform, remain comparatively free from disease. Hence, the hind-feet are easily dealt with by the shoer, who in them has to encounter scarely any of the difficulties that render his dealing with the fore-feet so often a task of extreme difficulty to himself, and of pain and injury to the animal; for when the fore-feet have been constrained to the performance of other and greater duties than those for which nature designed them, as unhappily is the case with nineteen out of every twenty of even the best shaped horses, the natural consequence has invariably shewn itself in a distressing number and variety of ailments, of which some are referrible to false action, others to malformation or misapplication of the shoe, and all are more or less dependent on the skill with which the shoer discharges his duty, for either a direct cure, or, indirectly, for alleviation or removal by other means. I have been thus particular in making the distinction between the fore and hind-feet of the horse, at the commencement of this Essay, as I propose to confine my inquiry principally to the form and functions of the former, and I therefore proceed to examine their structure: first, in reference to their bony framework; secondly, to their ligaments and muscles; and thirdly, to their horny covering.

§ 5. If the only use of the foot were to support weight, a direct prolongation of the shank might suffice for that purpose ; but the fore-legs of the horse, in performing their proper offices of progression, have not only to sustain the weight of the fore-quarters cast alternately on each, but also each limb has to be lifted up, and the concussion of the weight and impetus of the body, at each step, has to be avoided by further arrangements, which present a striking combination of numerous parts admirably adapted to one another, and to the general design.

§ 6. In order to the lifting up of the limb, the parts are so disposed as to draw it out of the way of contact with the ground at every step; and for this purpose the joint at the knee is made to bend, or present its salient angle forward. Again, as the foot, on leaving the ground, must be tucked up behind the limb, to keep it out of the way, and again, on coming to the ground, must be presented in advance of the limb, so as to prevent the impetus throwing the animal past his point of support, the several joints by which these latter operations are performed have a double capacity of bending both forward and backward.

§ 7. These latter joints are three in number, viz., that at the fetlock, corresponding to the ankle joint of the human foot; that at the pastern, corresponding to the human instep; and that at the lower pastern, corresponding, in some measure, to the toe joint of the human subject, only that here the several articulations of the human toe joint are consolidated into one mass, and the nails, which, in the human subject, cover only the upper extremity of each member, here surround the united mass with a continuous covering of horn, as well below as in front.

§ 8. For ascertaining the extent of action of these several joints we have an infallible index in the parts themselves, the rubbing surfaces being armed with a cartilaginous coating, which marks the extent of their action upon one another. Thus, if on making a section of any joint, the socket should shew, say an arc of forty degrees, while the ball shewed an armed convex surface extending through an angle of sixty degrees, the difference of twenty degrees would measure the amount of rotation of that joint. Applying this test to the joints described, we find that the action of the fetlock joint is measured by an arc of eighty degrees, that of the upper pastern joint by an arc of fifteen degrees, and that of the navicular joint, subject to the considerations hereinafter mentioned, by an arc of about thirty degrees. This is the amount and distribution of the action of a foot of the ordinary proportions, practically measured by the sector applied to the cartilaginous index. In other feet the numbers might be found slightly different; but this appears the average extent, and may be taken as a basis for measuring the amount of excess or defect of action in these several joints.

§ 9. It is obvious that bones which at every step assume varying degrees of obliquity in reference to one another, must be kept together by very strong attachments, especially when the weight of the horse's body has to be sustained by them in that oblique condition. We shall accordingly observe, that in proportion as the bones constituting these various articulations abut on one another more or less obliquely, they are provided with more or less strong attachments to one another; and that, whenever their action requires them to be in an oblique position while sustaining weight, a further and very effectual apparatus is provided for their additional support and connexion.

§ 10. Tracing the apposition of these bones downwards, from the extremity of the metacarpal, shank, or cannon bone (A),* we have first the upper pastern bone (B), ranging, as we have seen (§ 8), through a wide arc, both backward and forward; and in the latter position, when very obliquely placed with regard to the shank bone, having the ligaments of this joint burdened with the entire weight of the fore-parts of the animal. Here, accordingly, we find the attachments which keep these bones together while in the former condition, which takes place only while the limb is moving through air, free from burden, to consist of a thin, though strong and broad ligament, enwrapping both bones in front, and at the sides by ligaments termed lateral, while the connexion behind is secured not only by a thick and extremely strong ligament (*i*), but also by two additional bones (*h*), called the sessamoids, which, together with the upper extremity of the long pastern bone, constitute what may be termed the socket, or receiving portion of the joint. The socket of the fetlock joint thus consists of two portions; an anterior inferior part, formed by the upper extremity of the long pastern bone, and a posterior one, formed by the concave surface of the sessamoids, which, although distinct bones, are so closely united by ligamentous attachments along their line of apposition, as to present on the inner side a continuous surface, forming, as has been said, with the concavity of the upper pastern, a receiving portion or socket, in which the lower extremity of the metacarpal bone rotates.

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* See frontispiece.

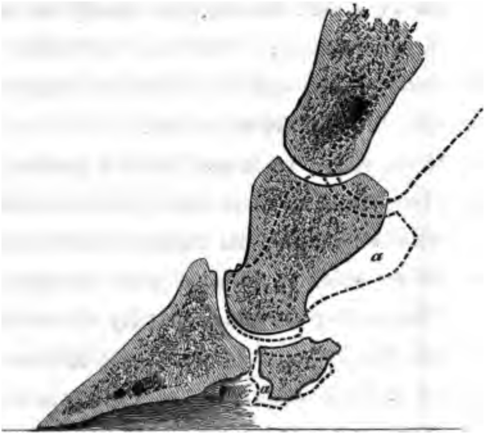
Now it will be observed, that the posterior half of this socket, that, namely, consisting of the anterior surfaces of the sessamoid bones, is not sustained by any other bony support beneath, but derives its support from being hung in its place by a fibro-elastic structure descending from the knee, and which, from the office it so performs, has obtained the name of the suspensory ligament (§ 18). This ligament, having the sessamoids set in its lower extremity, is antagonized by another one of great strength, which, grasping the sessamoids below, keeps them down in their position by a constant strain from its inferior points of attachment on the back part of the long, and on the upper part of the short pastern bone. Therefore, in the oblique position of the bones which has been alluded to, the greater portion of the weight is borne by this spring-suspended half of the fetlock joint socket; and in order to support them under the increase of duty thus placed upon the parts, we find the principal tendons of the foot carried over and behind these moveable bones, while the whole is further secured by a mass of ligamentous structure which wraps the entire joint, and firmly connects the adjacent bones to each other.

§ 11. Descending from the upper to the lower pastern bone (C), we find another joint, the action of which, as we have seen (§ 8), ranges through a much smaller space; the bones never exceeding a comparatively trifling departure from a continuous line, the connexion is sufficiently provided for by the anterior, posterior, and lateral ligaments of the articulation. The head of the lower bone, however, in which the socket is formed, is of so considerable a bulk, for reasons to be hereafter mentioned (§ 19), that it presents a rim or shelf of sufficient size behind, to afford ample security against any overshooting of the bones such as mentioned above (§ 10).

§ 12. We now come to the abutment of the lower pastern bone on the coffin or foot bone (D), which latter is the last of the series; and as all the parts become more solid towards the extremity, so here we find the provision for preventing the slipping of the joint (§ 10), effected not by two bones, as at the upper pastern joint, but by one, the navicular or shuttle bone (E), which not only sustains the junction of the lower pastern and foot bone, being bound up to both by the great foot tendon (§ 17), passing under and behind it, and to which it gives tension by its interposition, but itself constitutes the posterior part of the socket in which the lower extremity of the small pastern bone plays.

§ 13. This peculiarity of the socket of the lowest of the series of joints is very material to bear in mind. It is at the extremity of the limb that the shocks are first received; here, accordingly, we find the provisions against concussion repeated in a manner the most complete and effectual; for the navicular bone constituting the posterior part of the socket in which the small pastern bone works, is not itself directly sustained by any other bone, neither is it suspended, as the sessamoids are, by an elastic ligament from above, but it reposes in the embrace, as it were, of the great flexor tendon (*f*), which, springing from the bottom of the foot bone, and passing behind and under the navicular, braces it up to its position, while it rests, in its turn, on the elastic cushion usually called the fatty frog, of which mention will be made further on (§ 29). But, besides the support of the great foot tendon, the navicular bone is also sustained in its place by ligamentous attachments, to the foot bone in front (*v*), and to the lower pastern bone behind (*t*); and again laterally, by like attachments, to the cartilaginous walls of the foot at either sides; so that the ultimate weight and impetus of the animal are cast on a joint, the socket of which is formed, half by the foot bone (the elastic connexion of which with the hoof will be hereafter noticed, § 27), and half by the navicular bone, which, slung behind in its attachments, and sustained by the flexor tendon and the elastic cushion, has exactly the same effect as if, in mechanics, a beam were supported on a double elastic socket, each half of which being in its turn supported by a series of springs.

§ 14. If the socket so formed were a portion of a sphere, it is plain that, in revolving in it, the lower pastern bone would apply its surface equally to both portions of the socket: but such is not the fact; the cavity of the socket and the extremity of the lower pastern bone being both of an oval shape, their section shewing an arc of an ellipse, of which the greater axis is nearly horizontal. Hence, a remarkable difference in the action of the lower pastern bone on this socket, according as it reposes in it more or less obliquely; for, as the bone rises in the socket, it will be seen that its extremity withdraws from the surface of the posterior half, formed by the navicular bone impinging on the anterior portion of the socket, and then, in return-ing to its oblique position, transfers the pressure back to the navicular. The space through which the navicular bone rotates in this movement is marked by *a* on the subjoined woodcut, as also the still more considerable space traversed by the upper part of the lower pastern bone while passing from its oblique to its erect position. The engraving (a section) shews the lower pastern bone in each position, the amount of its rotation being determined by the extent of surface tipped with cartilage at its lower end; for, as has been observed (§ 8), in all animal organization, the rubbing surfaces of the joints are furnished with a cartilaginous



coating, as smooth as enamel, yet elastic, and continually lubricated, as are all the other rubbing surfaces of the animal tissues, with a secretion to defend the parts from the effects of fricton, in this instance termed *synovia*.

§ 15. At every step, therefore, taken by a horse moving in healthy action, the posterior half of this, the last and lowest joint of the limb, yields, and in yielding diminishes the force of the shock. But this yielding of the navicular bone, and revolution of the lower pastern bone, are attended with a consequence of the utmost importance to be fixed in the memory, for their descent necessarily displaces the parts adjacent, thereby causing a lateral expansion as the only way in which room can be made for the descending bodies. And it is this motion of the navicular bone, as part of the socket of the lower pastern, and of the lower pastern bone itself, in its action in that socket, which principally conduces to that expansion in the body of the foot, to which I shall have occasion so often to advert in this Essay.

§ 16. Hitherto I have spoken of the tendons as merely connecting the different bones; but they also serve the purpose of giving motion to them, the bones respectively being provided with extensors and flexors; the former of which, attached in front, assist in moving their respective bones forward; the latter, attached behind, both pull back their respective bones, and sustain the weight which otherwise would displace them when in their oblique relations. The same difference, as already adverted to (§ 9), is observable according as they are destined to work the joints of the limb when merely moving through air, or when the bent joint has to sustain weight, being in the one case of inconsiderable size, and in the other of great strength and considerable thickness. Thus, all down the front of the limb, these tendons lie flat and thin over the different joints, being scarcely perceptible; while behind, where they have to do their duty under the pressure of weight and impetus, they are prominent objects, and may readily be distinguished projecting under the skin.

§ 17. Beginning from the under and posterior surface of the foot bone, the great foot flexor, called the *perforans* or *perforator* (*f*), passes, as has been said (§ 13), under the navicular bone, after overlapping which, it goes up by the back of the lower pastern bone, and thence ascends past the articulation of that bone, with the upper pastern, and so takes its course behind the sessamoid bones, up the leg to its proper source of motion in its insertion in the muscles of the shoulder. Its name, *perforans*, is given from the appearance it presents in reference to the other flexor (*g*), which it seems to pierce where it passes underneath it, just below the sessamoids; and hence the latter, which exhibits the appearance of being a sheath to the former, has also acquired its name of *perforatus*. The *perforatus* flexor (*g*), springing from various points of attachment along the sides of the lower pastern bone, a portion of it also commingling with the substance of the cushion at the heels, passes, with the *perforans*, behind and over the sessamoids, and thence, wrapping the latter in its embrace, proceeds up the leg to the shoulder. The next structure to be noticed, found on the posterior part of the limb, is the suspensory ligament, which has been already alluded to in connexion with the fetlock joint. This shall be noticed more in detail as we proceed. The extensors, which lie on the anterior part of the limb, and correspond to the flexors, are attached to the surfaces of the bones which they are to put in motion; then, spreading in thin layers over the front of the bones next respectively above, proceed along the limb to their seat of motion, where each is provided, in like manner, with its proper muscle. These several muscles being put into action at the will of the animal, furnish admirable provision for retracting, throwing forward, flexing, or extending the limb, according as the demands of the pace or volition may operate. Now the muscles, in addition to contractibility, or that property by which they contract or shorten themselves obediently to the will of the animal, or the action of irritants directly applied to their fibres, have another quality pertaining to them, which is called tonicity: this is nearly allied to elasticity; by virtue of it, even while in repose, they are kept in a certain state of tension.* Now this property enables the muscles to discharge an important duty in the economy of the animal, for by it they have associated with their motor power a sustaining capability, owing to a degree of tension being always present; which, in certain conditions, as when the bones are obliquely placed with regard to each other, tends to counterpoise the downward influence of the weight, and be a security against displacement.

§ 18. But the remarkable office which, in this respect, is discharged by the suspensory ligament, and the provisions by which it is effected, claim at once our particular attention and admiration.

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* The existence of this quality is attested, by severing a muscle in a living animal, although the limb may have been previously brought into the most favourable condition for relaxing that muscle.

This ligament is connected superiorly by a very extensive attachment to the upper and back part of the metacarpal or cannon bone, having connexion here likewise with the splint bones; from this the ligament proceeds behind and along the metacarpal bone, soon becoming free and distinct as a strong round cord, in which state it is until it approaches the lower extremity of the bone; here it bifurcates, or divides into two portions; these pursue their course downwards, until they arrive at the sessamoid bones, with which they are firmly connected, by the insertion of the greater bulk of their fibres into two deep grooves furnished for their reception; some few of them, however, take a more oblique direction on the sides of the pasterns, and finally unite with the principal extensor tendon in front.

From the lower part of the sessamoid bones a strong and dense band of fibres descends along the upper pastern bone, to which it is connected (marked *k*); proceeding downwards, it is finally inserted into the projection at the back of the lower pastern bone.

This ligament would seem, at first sight, to be a continuation of the great or superior suspensory ligament, as it is termed, with only the interposition of the sessamoid bones; its structure appears to be merely fibrous, and not to differ from the ordinary ligaments found elsewhere in the body, its principal duty being that of antagonizing the suspensory ligament, by giving connexion inferiorly to the sessamoid bones, to which likewise, from its flexibility, it permits that change of position necessarily occurring in their situation over the flexure of the joint.

In addition to these provisions, we find the bones connected at their articulations by ligaments called capsular, lateral, &c., and which are termed so, according as they either wholly surround the joint, or are partially disposed upon it.

But the great or superior suspensory ligament is the structure here which claims our most particular attention. This ligament differs from those ordinarily found in the body, for it is constituted of a fibro-elastic material, by which is associated, in its construction, great strength, together with a power of extension and recoil. The existence of this latter quality in this situation furnishes evidence of great design in the admirable adaptation of means to an end, for when we come to review the position of this ligament, its attachments, the parts it supports, and the conditions under which its combined powers are brought into requisition, we find it to exhibit a most provident arrangement for relieving, by sharing the duties of the muscular system at periods of exertion, when such must be of great moment to the animal; for, while by virtue of its strength it can efficiently support and connect the parts to which it is attached, it moreover, in consequence of its elasticity, is enabled, when extension of the fetlock joint takes place, at once to retract or flex the foot, without any increased demand being made on the muscles; and the value of this, under certain circumstances, such as of great speed, in economizing to some extent the exaction on the muscular system, cannot fail to be discerned and appreciated.

§ 19. To the mechanism of the foot itself we have now to turn our attention; and here it will be necessary to go probably more into detail, as upon a correct and thorough knowledge of the constitution and functions of the parts immediately connected with it, can alone depend a due intelligence of those principles which seem to guide and direct its operations, and on which is based the theory we advance for sustaining the healthy, and remedying the abnormal conditions, of this important part.

Now the shape of the lower or short pastern bone is deserving of especial notice. Its particular anatomical relations have been alluded to (§ 11). When viewed with regard to its length, this bone is more or less of a wedge shape. The smaller end being inferior, articulates with the navicular and coffin bones, and is, consequently, partly enveloped by the hoof, the upper or larger portion extending a short way above the level of the coronet. The enlargement of the superior extremity of this bone is attended with a very material consequence; its posterior margin projecting far behind the articulating surface of the joint, seems not alone a provision for the attachment of the ligament antagonizing the great suspensory one, but also gives to the former increased mechanical power, by having its insertion farther removed from the axis of motion. It likewise presents to the action of the great foot flexor a pulley-like surface, similar to that found inferiorly on the navicular bone. But another important function associated with the enlarged upper extremity of the short pastern bone remains to be noticed. When not encumbered by the weight of the animal, this bone assumes the erect position, but when acted upon by weight and impetus, we find it deviating from the perpendicular, and passing backwards, the upper or larger extremity sinking between the wings of the hoof. The navicular bone, at this stage of the movement, is called into requisition, and by its yielding capabilities accommodates the sinking pastern. The elastic cushion called the fatty frog, (§ 29), now impinged upon, is compressed in a downward direction, while it expands laterally, and thus, as shall appear, the shape of the short pastern bone, and the variations of position to which it is subject, are subsidiary to that expansion in the hoof itself, which is essential to the healthy and efficient discharge of the duties of these parts.

§ 20. There being, then, this necessity, from the very structure and frame of the foot, for an enlarging and contracting apparatus around the seat of the navicular and lower pastern bones (§ 15), nature has provided for the enclosure and protection of these parts by a substance, at once hard enough to resist the ordinary collisions to which the animal is exposed in running on the turf in a wild state, and at the same time so *elastic* as to yield all the necessary accommodation to those important inward motions. This is effected as beautifully as effectually, by surrounding the whole apparatus of the foot with a box of horn, presenting a wall of about half an inch in average thickness (*r*), round the front and sides of the foot, clothing it downward from beneath the junction of the lower and upper pastern bones, and forming a bottom, or sole (*s*), underneath, of a still greater degree of strength and thickness.

§ 21. And, as an elastic box of this kind could not expand and contract laterally, without tearing the bottom, unless the latter be provided with some means of compensating the action, so we find the sole is provided with a duplication, or fold, which, by opening out and shutting up, according as the walls recede and approach one another, compensates for this motion, and at the same time keeps the sole, or bottom of the box, complete. This duplication—this gusset, as I may call it, set into the sole—is the frog (*q*), and is formed of a much softer substance than the rest of the sole, beyond the general level of which it projects: and this is another circumstance which is to be well borne in mind, for the frog coming in contact with the ground at every step, in a healthy state of action, that pressure *forces it to* open, and so expands the heels between which it is placed, making room for the internal action to which I have so often alluded, and thus accommodating the requirements of the navicular and lower pastern bones during their descent, which occurs at the moment the weight is cast upon them.

§ 22. The form of the sole, concave below, and sustaining its burden on an arch, is generally supposed to give rise to this action of expansion in another way as often as the superincumbent weight, pressing on the crown of the arch, spreads it laterally; this lateral pressure, it is thought, pushes aside the walls, which act in respect of the arch of the sole in the same way as buttresses in an ordinary building. But the application of the iron shoe so entirely transfers the weight from the sole to the extreme crust, that, treating the foot as furnished with this artificial protection, we never find this source of action in actual operation.

§ 23. But the structure of the sole is such that it cannot expand horizontally, though equally yielding as the walls in a vertical direction, without tearing. Hence it is evident that there can be no expansion except such as possibly may be attendant on the depression of the arch (§ 22) beyond the point of the frog, which is the proper apparatus provided in the sole for that purpose;

and thus the size and position of the frog afford us a practical measure of the extent and direction of that action which it is so important to the shoer to understand.

§ 24. And here it is desirable to notice with particular attention a quality of this horny covering, which subserves the most important purposes in keeping the internal parts in their proper position, and in healthy action, and is equally productive of the most serious evils where the action is unhealthy, viz., the elastic inward spring of the hoof. We have seen elsewhere beautiful arrangements of mutually compensating and adjusting forces, every downward impulse being counterpoised by an equal upward traction; and so in this case we find every agency tending to spread the parts of the foot from within, met by an equal force tending to push them back to their former position in the clasp of the horny covering from without, and which gives the heels a perpetual tendency to fly in on the removal of any of the distending substances or forces by which, in the healthy foot, they are kept open.

§ 25. I now proceed to the arrangements by which nature has provided for the formation of this horny covering. Horn, scales, nails, hair, and feathers, are equally productions of the cutis, or true skin; and, on looking at the arrangement of the cutis round the foot of the horse, we find a band encircling the upper part of the foot called the coronary ligament (*l*), which, together with the membranous clothing on the exterior of the coffin bone (*m*), deposits the upright wall; thus protecting the foot from collisions in front, while that for the formation of the sole and frog is secreted by a further arrangement of the same cuticular structure, situated beneath the foot and navicular bones (*n*), and extending into the material of the heels. This structure is termed the sensible sole and sensible frog. In these deposits three qualities of horn are produced: one, constituting the walls, hard and elastic; another, constituting the sole, hard, and comparatively inelastic, approaching to bone in its density; and a third, that which forms the frog, of a soft character, and almost as elastic as Indian-rubber. The degree of motion required has evidently governed the arrangements of these parts—a hard and almost bony surface being presented wherever the necessities of the structure did not require accommodation for motion; and where the necessity for such accommodation existed, a substance of greater or less elasticity being provided.

§ 26. The prevailing care to prevent concussion is as apparent in the attachment of this horny case to the foot, as in any other of the arrangements already noticed. It has been observed (§ 12), that the socket in which the lower pastern bone plays, is formed half on the upper surface of the foot bone, and half on that of the navicular bone, and the yielding character of the latter has been adverted to (§ 13); but the foot bone, which divides, with the elastic cushion, the ultimate force of each step, exhibits a still more complete and wonderful provision against concussion, being suspended, as it were, in its horny covering by an infinite number of minute elastic supports (*p*), the contemplation of which cannot fail to excite the admiration of every reasoning mind.

§ 27. The cutis which throws out the horn does so by the production of laminæ, which at their origin are of the consistence of hair, but which thicken and solidify as they grow, until, at a distance of about the eighth of an inch from their first development, they coalesce into a compact body of horn. The interstices between these laminæ are occupied by corresponding portions of the cutis, so minute, however, that the number of interpenetrating surfaces from heel to heel amounts to many hundreds. The direction of these mutually clasping processes is parallel all round the foot, and, if the crust were a perpendicular wall all round, it is evident that, unless supported beneath, the foot bone, pressed by so great a weight as it has to sustain, should at once slip out of these attachments, and descend through the hoof to the ground; but the crust, instead of a perpendicular wall, presents a surface sloping from the coronet to the toe, and the laminæ being all round parallel to one another, the apposited surfaces, as they approach the hinder part of the foot, become more and more oblique to the pressure, until at the heels they resist the downward impulse at an angle of about forty-five degrees. Therefore, at one stage of every step of the animal, the foot bone is pressed down on those numerous springs, with a force parallel to their direction, towards the toe, but which, at every point, as it acts backwards, is met by an increasing resistance, proportionate to their increasing obliquity; and, slender as those laminæ individually are, such is the strength of their connexion with the cutis covering the bone, and such their elastic aptitude for breaking the shock of concussion, that it is alleged, that on cutting away the sole of the foot, the external wall alone was found to support the whole weight of the horse through the mere strength of these attachments, by which, as has been remarked, the foot bone is suspended within its horny integuments.

§ 28. The cutis beneath the foot bone, being that which throws out the hard substance of the sole, is not united to its deposits by laminated attachments; its villous processes giving out the horny matter vertically, instead of laterally as in the upper crust, except for a very small space on the inside of the bars, where the shape of the parts requires that the deposit should be lateral, just where the hard substance of the sole passes into the soft, transparent, horny matter of the frog. Between these spots of laminated deposit and the outer wall, the hard sole, vertically deposited as above-mentioned, is continued into the angle of the heels, the intention seemingly being to interpose a rigid substance between the frog and the external crust, which should transmit directly the action of the former to the latter. This part of the foot is remarkable for having the crust or wall much thinner on the inner than on the outer side, as well as being the seat of corns, sand-crack, and contraction; diseases which shall be noticed in a subsequent part of this Essay.

§ 29. Another important part of the apparatus of the foot, which has already been mentioned as the fatty frog (§ 13), remains to be noticed in connexion with the depositing surface of the cutis. This highly important organ, consisting of a substance closely resembling Indian-rubber, is interposed in a cushion of considerable thickness (marked *oo*), between the navicular and lower pastern bones and the heel, its greatest thickness being immediately over the posterior part of the frog. The word "fatty" very inadequately describes the consistence of this remarkable mass of elastic fibro cartilaginous structure, which, even in the dead animal, preserves an elasticity equal to that of caoutchouc, and is manifestly designed to share with the foot bone one-half of the weight and impetus of each step communicated to it by the descending action of the bones before alluded to. Its elasticity, however, is not that of a body like air, which in its elastic state occupies a less space; for, when pressed vertically, the elastic frog expands laterally, and *vice versa.* Hence the necessity for these provisions for lateral expansion so often referred to, and which, at every step, are called for by the action of this organ.

§ 30. The blood-vessels which convey the material for the horny and bony deposits in this situation, descend along the back of the series of bones which I have described (§§ 10, 11), to the lower extremity of the short pastern, where each throws off branches that proceed to their respective destinations. One at either side passes to the coronet, supplying that highly vascular apparatus for secreting the hoof, which is incessantly growing; while other branches descend to the cushion and cutis beneath it, for the supply of the cartilages and frog. Again, we find a branch from each passing round the extremities of the navicular bone, and ramifying through channels in the substance ofthe foot bone to the cutis surrounding it, for the formation of the laminated horn ; and another branch at either side descending directly past the wings of the foot bone, to its under surface, where it is distributed, and supplies the sole.

§ 31. Having thus examined the structure and functions of the foot, in regard to its bony, ligamentous, and cuticular properties, and seen the variety of contrivances which it exhibits for avoiding concussion, and for providing for the elastic action of the parts produced in that avoidance, I now proceed to describe the principal disorders to which these parts may be subjected by improper treatment; after which I shall conclude, by considering the best method of qualifying the animal for the artificial road, by arming this *wonderful structure* with a suitable defence.

# CHAPTER II.

## DISEASES OF THE FOOT, AND HOW CAUSED.

The structure and functions of the healthy foot being such as we have seen them, we will now proceed shortly to enumerate the principal forms of disease to which these parts are liable; after which I will examine the several causes to which they may respectively be ascribed.

§ 32. The most general departure from the healthy state is seen in that form of disease called *contraction*. The nature of this ailment is well expressed by its name, the prevailing symptom being a contraction or drawing in of the hinder parts of the foot, accompanied by a diminution, and in some cases an almost complete absorption and obliteration of the frog, the toe, at the same time, becomes elongated, so that the sole, instead of the circular form of the healthy foot, assumes the oblong shape of the hoof of the ass.

In this condition of the foot, when not accompanied by inflammation, considerable powers of action and endurance may remain; and the distinguished writer, Nimrod, even alleges that such contraction, at least in its milder form, is practically no disadvantage; a position, however, from which the writer of this Essay altogether dissents, for reasons which will be fully assigned further on (§ 44). But where inflammation attends this narrowing of the foot, there is no difference of opinion as to the seriously injurious character of the disease, which, in such a case, is invariably attended with lameness, greater or less in proportion as the internal parts of the foot are engaged in the inflammatory action.

Of the various forms of lameness arising from inflammatory action, that of the navicular joint (§ 12) is the most frequent and formidable, resulting not unfrequently in an adhesion of the flexor tendon to the under surface of the navicular bone, which being disrupted in any effort at free action in the parts, causes almost hopeless lameness, and often renders the navicular bone itself the seat of ulceration and caries. This may be taken as the type of all the diseases which affect the joints of the foot and pasterns, and which attend the presence of inflammatory action, wherever it occurs among these numerous and complicated parts, the evil exhibiting itself in adhesions which, in extreme cases, result in lacerations and caries, and are, in all their stages, attended with more or less loss of action, from slight lameness to complete founder.

§ 33. The next class of diseases in the foot to which I would advert, are those affecting the horny deposits, among which, both for frequency and importance, the first placed may justly be assigned to *corns*. It is a prevalent error to confound these carneous excrescences of the sensible sole of the horse with the horny indurations of the epidermis of the human subject. The corn in the horse is, in fact, a product of the *cutis*, which, instead of depositing the hard and insensible particles of which the sole is properly composed, is found at a point of the inner heel of the fore foot, just in the angle formed by the heel and the bar, to run into a fleshy and sensitive overgrowth, giving to the sole the appearance of being full of minute blood-vessels, and causing much suffering and lameness to the animal, from the contact of that sensitive surface with the ground.

§ 34. A general engagement of the sole of the foot in such inflammatory action produces a softening of all its parts, which causes the sole to lose its natural concavity, and to protrude beyond the plain of the bottom of the crust. This disorder has received the name of *Pumiced Feet.*

§ 35. Another disease incident to the horny deposit is *sandcrack* which resembles corns in this circumstance, that it occurs almost uniformly on the inner side, where the wall is generally formed of a thinner substance. It consists in a disruption or tearing of the crust of the hoof downward from the coronary ring towards the sole, resembling those blemishes which may frequently be seen on the nail of the human finger, and, like all other ruptures of the horny structure, is liable to ulcerate and cause serious distress, and loss of value, to the animal.

§ 36. *Ringbone* may not improperly be included in this category, although being a deposition of bone at the pastern joint, but which, if not arrested, sometimes eventuates in ossification of the coronary ligument, that contributes to the supply of the horny secretion; the unnatural deposit at these points is necessarily attended by suffering and lameness, the bony excrescences interfering with the action of the principal *extensor* tendon.

§ 37. *Thrush* exhibits itself in the cleft of the frog, attended with fœtid exudations from the cutis immediately above, and when the cutis has become extensively engaged in inflammatory action, suppuration takes place, followed by a copious discharge, and the disease assumes a very troublesome character.

§ 38. Bruises, wounds, or any other exciting cause of inflammation, may induce the cutis either in front or underneath to suppurate. When this takes place to such an extent as to cause abscess, whether it be under the crust or sole, the symptom is termed *Quittor.*

§ 39. Thus we perceive that inflammatory action accompanies all the diseased conditions of the foot except in the case of contraction in one of its forms. I shall now proceed to indicate the causes of these various departures from a healthy condition of the foot, which I trace to the operation of two causes, severally and conjointly, viz., to false carriage, and a vicious mode of shoeing.

§ 40. I shall first investigate the effects of false carriage, inasmuch as it is evident that no improvement in the method of shoeing can give permanent relief where the source of the malady is inherent in the habitual carriage and action of the animal; although the best carriage may be vitiated, and all the inflammatory diseases I have enumerated may be induced on a horse in perfect balance, by the injudicious shoer. I desire to repeat and impress this on my reader, that no skill in the shoer can compensate for a vicious carriage, or avert the diseases attendant on it, although want of skill in the shoer will induce all of them, with the exception, perhaps, of non-inflammatory contraction, on the best stepping and best balanced horse in the world. No skill in the tailor can prevent a man habitually stooped from having a narrow chest; but an ill-made garment will embarrass, and if we supposed it, like the shoe of a horse, inflexible, and made of iron, would certainly induce disease in the healthiest lungs.

The main propelling power of the horse lies in the haunches, the bones of which, by opening out from the contracted state in which they are when the foot comes to the ground, at every stride shoot the body forward from the *point d'appui* of the hind foot, in the direction of the least resistance. The hocks and hind pasterns also contribute to this propelling agency, which is all the active power employed by the animal when running in a natural state. For the principle on which this proposition is established, the reader is referred to the Essay on Training, where those results are proved from simple mechanical principles. For the present purpose it is necessary only to investigate the action of the fore feet as sustaining the weight and impetus. It has been seen that the foot has to come in advance of the limb. On looking at the line so formed by the extended limb and foot of a horse in perfect action, it will be observed that their direction has exactly the degree of obliquity necessary to prevent the overshooting of the weight to be sustained, and which at the same time offers the least degree of resistance to its progress to the next point of support. But considerable varieties are observed in this respect, and in particular we find many horses distinguished by short pasterns, and whose feet stand much more directly under the line of the leg than others. The action of horses so formed is rough and "stilty," owing to the too limited extent of pastern action; while horses, on the other hand, whose feet are placed too much in advance of the line of the limb, however easy and graceful in their movements, are defective both in activity and endurance; and, owing to the great accommodation required for the rotation of the foot bones in animals of their make, are peculiarly liable to all the inflammatory symptoms which attend on any interference with that action.

§ 41. To proceed with the examination of the action which takes place among the parts in question. While the foot is in air, the elastic clasp of the quarters, no longer antagonized by the thrust of the weight, keeps the heels closed; and the fatty frog, having nothing to compress it, rises to its full volume, following the ascent of the navicular and lower pastern bones, as shewn by the undotted lines in the woodcut. Immediately on the foot coming to the ground, the superincumbent weight forces down the lower pastern, into the position shewn by the dotted lines, and it, as we have seen, bears on the posterior half of the double socket with a force proportioned to its obliquity (§ 14), so that the navicular bone, which forms the posterior half of the socket in question, is also thereby pressed down at the same time. The frog at the same moment coming in contact with the ground, and pressed open by the stress of the weight, expands the quarters and lateral cartilages so as to make room for the spreading of the elastic cushion compressed under the descending masses of these bones. The next movement, as the weight shoots past the point of support, and the animal prepares to lift the limb preparatory to the ensuing step, raises the head of the lower pastern into a more perpendicular position; and the stress being thus taken off the cushion, it rises and fills the vacated place; while the labour being transferred from the posterior to the anterior half of the double foot socket by the lower pastern bone assuming the upright position (§ 14), the navicular bone also rises, following the movements of the lower pastern (§ 14), and followed in turn by a corresponding expansion of the elastic cushion. Now the increased stress thus thrown on the foot-bone, transfers the burden to the cutis in which the foot-bone is suspended by its laminæ (§ 27), and the heels being so relieved from the force which kept them open, the frog closes up, and the quarters clap in again round the rising cushion, in which condition they remain, until the next step repeats the process, by which they are opened out again by the force of the descending bones, and so on at each step.

§ 42. From first to last the movement exhibits a succession of transfers of force from one springing medium to another, the bones descending on tendons themselves elastic or attached to elastic muscles; these tendons in turn reposing on an elastic cushion; that cushion clasped by elastic cartilages; and these cartilages attached by elastic laminæ and filaments to the horny box which thus receives the remaining force of the step, after first its impetus has been distributed through, and broken by the elastic apparatus of the heels and quarters.

§ 43. The most apparent of these motions may be observed by any one with a quick eye inspecting the movements of the animal in action ; such as the descent of the lower pastern and its return to a perpendicular position; but the numerous delicate movements to which this change of position of the lower pastern bone gives rise eludes the keenest eye in looking at the living animal, and can only be observed by the anatomist inspecting a section of the dead limb, and working the parts with the hand.

§ 44. It is obvious that in proportion to the length and obliquity of the pastern bones will be the amount of action excited ; a short bone evidently descending through a smaller space, and requiring a less displacement of the parts beneath, than a long one, just as is the case with the arm of any other lever. But it has been remarked (§ 40), that some horses have naturally very short pasterns ; in these, therefore, there will not be any extensive demand for expansion and contraction; and when we reflect that this action, even in horses with springy pasterns, passes through but a small space on each point of the crust (the action being distributed over so large a surface), we will not be surprised to find that in short-pasterned horses the amount of movement is very trifling indeed. Now it is in horses of this description that the non-inflammatory contraction, of which I have above spoken, is to be found, and in no others. The reason is obvious: the parts demand little or no accommodation; consequently the apparatus provided for accommodating such demands wastes away, according to the uniform law of physiology that regulates the size of each organ to the duties it has to perform. The result is that the frog, cushion, and all the parts usually called into action, diminish in volume; and this diminution, arising from no alteration in the structure of the parts, but merely from inactivity, is not accompanied by any feverish symptom; hence the non-inflammatory character of the symptoms. This is the contraction spoken of by Nimrod when he declares that contracted feet are not so much objectionable as is generally supposed. But with such a foot, however free from sensitiveness, the horse cannot be said to have good action. Such a horse must always go on stilted pasterns, and be not only rough to ride in consequence, but also be deficient in speed and safety on the road; and however fully I acknowledge the general ability and good sense of Nimrod's observations, I cannot pass his statements on this subject without protesting against views which are not in accordance with the economy of nature; for, to admit Nimrod to say that contraction, unaccompanied by inflammation, is no objection, is to admit that the pastern joint and the expanding apparatus of the frog are useless provisions, since in that state of the foot neither of these organs can have any operation. Feet of this kind are, however, so very rare as to be almost *lusûs naturæ.* Not so, unfortunately, that class of contracted feet which owe their deformity to false action, and which are accompanied, invariably, more or less by inflammation.

§ 45. Faulty action, as has been shewn in my Essay on Training, arises from the effort made by the animal to compensate for the displacement of the natural centre of gravity, caused by the imposition of weight on the ordinary seat of burden, in advance of that point, by calling in the fore-legs in aid of the haunches, and making the former perform the part of propellers, by bending the knee and grasping at the ground with the toe. This action, I have shewn in the Essay, is necessarily attended with a straightening of the pastern, without which the bending of the knee would leave the anterior supports so much shorter than the posterior, that the advantage of the new propelling action, unless so compensated, would be more than counterbalanced. This straightening of the pasterns, I have also shewn, necessarily throws the fore foot back from its proper position to one nearly under the point of the shoulder, whereby the gait becomes not only tottering and insecure, but many disorders are caused in all the limbs, which I have enumerated and traced to their source in the Essay*. But my

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* Amongst the causes of false carriage and contraction, that of the ordinary stall, with its inclined plane, should not be overlooked. Those who are acquainted with the habits of the horse cannot have failed noticing the efforts he makes to relieve himself from the inconvenience he feels when confined in such a stall; he tries to remove his collar, and having succeeded, and satisfied his appetite, he invariably stands with his tail towards the manger. If not able to remove his collar, he may be observed standing across in the stall, provided it be sufficiently large to accommodate him; otherwise he moves backward, with the hope of finding a level, until he meets with the elevation at the opposite side of the channel; on this placing his hinder feet he is perfectly at ease. But in this indulgence he is too often interrupted by the admonitions of the groom, for disordering the stable, and as a punishment confined to the rack-rein.

Nature has been bountiful to the horse in supplying a means through which he can repose while standing, independently of the aid of muscular agency; this is effected in all his limbs by the suspensory ligament and its antagonist, in connexion with business here is to shew the destructive effects of such action on the fore feet; and first, the erection of the

the sesamoid bones, which have been remarked (§§ 10, 18) as forming the support to the sinking pastern. It follows, from the arrangement of these parts, that the weight of the animal will suffice to keep the knees straight, while the sinking pastern is supported by the apparatus connected with the sesamoid bones; by this admirable contrivance, and without any tax upon his exertions, the animal's own weight is made subservient to his support.

Now, it will be seen that the inclination of the stall renders it physically impossible that the horse can stand as nature designed, the direction of the plane being the reverse of that of his pasterns; therefore, in order to place his feet flat, he is obliged to bring them considerably farther back than they should be, and, as a necessary consequence, stands on straight pasterns; in this position the natural angle at the pastern is destroyed, or so much lessened that the suspensory ligament is relaxed to such extent as to become inoperative, its elasticity not being developed under the circumstances. Muscular exertion is now called upon for the purpose of steadying the animal and supporting the weight. The flexor muscles, obedient to the demand (which is the *need*), are brought into action, and by the contraction of these muscles their tendons are closely applied against the back of the sesamoid bones, and along what may be termed the range of the pastern joints, and in the condition in which they are thrown, they have to discharge the duty for which another structure was designed. Now such a state of affairs cannot be preserved without the endurance of muscular exertion, and the sustained action necessary is not compatible with a known law in the animal ecopastern in cases of this kind is a condition of a widely different character from that of mere shortness of the pastern, such as in the non-inflammatory contraction of Nimrod. A horse with naturally short pasterns has no inducement to erect them to make up for the deficiency in the height of his supports. It is the long-pasterned horse alone that finds himself invited to the use of such a succedaneum, the means of relief being, in such cases alone, adequate to the demand. Now we have seen (§ 44), that, the longer the pastern, the more ample are the provisions made for elastic action within the foot. But, the longer the pastern, the greater also is the temptation to erect it into a prop to compensate for loss of height

nomy, which provides that intervals of relaxation or repose are required.

The evils resulting to the foot from this unnatural position are manifest; the navicular bone, being drawn up against the back of the small pastern bone, must become irritated on its surfaces as well as in its ligaments; the elastic cushion which was designed to sustain the weight of the sinking pastern, and by its resistance to keep the heels in a state of expansion, now follows the ascent of the elevated pastern, and allows the heels to close in. The hinder feet are exposed to contraction from the same causes, but the consequences are not so disastrous, owing to the greater number of angles in the limbs, as well as by their being prevented, through false position, from participating in the labour.

in the supporters. Hence, when a horse goes out of balance, it may be affirmed as a general rule that the more expansive are his feet the greater is the danger of contraction; for the pastern bones in that case will be longer, and therefore will be more injuriously employed, serving as props instead of springs, and leaving the elastic parts, on which they ought to have acted, to waste away for want of occupation. Now if this wasting were all the consequence, the result would be mere non-inflammatory contraction, such as that spoken of above. But, while the erection of the pastern bones leaves the hinder parts to shrink, as in the case above adverted to, a great difference is to be observed between its effects and those of the merely short pastern, in respect of two most important parts of the foot, viz., the navicular and the foot bones. No matter how short the lower pastern, it will still revolve in its double socket, pressing alternately on the navicular and foot bones, during its change from an oblique to an erect position; so that the action of the navicular at least is never lost, however much the shortness of the upper part of the bone (§ 44) may diminish the arc through which it moves in displacing the elastic cushion. Thus, in the non-inflammatory contraction, arising merely from shortness of the lower pastern, there is still some play of the navicular, the surface of which is thus kept in constant action against the surface of the flexor tendon. But, in the case of long and oblique pasterns erected for the purpose of affording support, the lower extremity of the smaller pastern does not rotate through the whole of its arc. It never assumes its full obliquity, and so never gives its full pressure to the navicular. The consequence is, that the navicular, in extreme cases, lies up against the back of the lower pastern without motion, and reposing immoveably in the grasp of the great flexor behind and underneath, the secretion of synovia designed to lubricate the rubbing surfaces (§ 14), and which is supplied only so long as demanded by the rubbing action, ceases, and inflammation supervenes; adhesions then take place, and, after adhesion, suppuration, and the worst form of lameness in *Navicular Disease* (§ 32).

§ 46. The erect pastern throwing, as we have seen (§ 14), an undue pressure on the foot bone, and, through its intervention on the horny laminæ, which, as has been shewn (§ 27), are designed to sustain only the last and least trying impulse of the step, also that the pressure of all forces acting on the foot bone is borne by the laminæ in the proportion of their obliquity to the direction of the force; and as their obliquity is greatest, as well as being most shallow, in the angle formed by the heel and the bar, the cutis becomes irritated by the undue pressure, inflammation supervenes, and exhibits itself in those deposits which, penetrating the crust of the sole, becomes acutely sensitive to the touch of external bodies, constituting the well-known symptom *Corns* (§ 33).

§ 47. Other diseases of the limbs, namely, *Splents* and *Ringbone*, are attributable alike to concussion through the upright pasterns; it will be found that these diseases generally precede those of the foot, otherwise, the tenderness of the foot induces a cautious movement, insufficient to excite the amount of inflammation necessary to the production of *Splents* and *Ringbone*.

§ 48. But there are also new mechanical forces put in operation by this erection of the pastern, without considering which we cannot follow out the destructive effects of false carriage to their full extent. The limb being brought back to a position behind its proper place in advance of the shoulder, cannot bring the foot flat to the ground; neither does the animal, when employing these illegitimate means of compensating for the loss of power in his true propellers, seek to plant his foot in that position, but, as I have shewn in my Essay on Training, urges himself forward by alternately grasping and pushing with his fore feet, catching at the ground with the toe as the foot comes down, and pushing himself forward from the quarters, as the weight shoots past its point of support, at every step. This action it is which makes every horse going in false carriage so unpleasant to ride; and when the rider feels his horse jerking under him with this sort of effort, he may be quite sure that he will not long escape narrow heels and corns; for the action of catching at the ground with the toe in the first stage of the step, is alone sufficient to elongate the horny box, and draw it out in the direction of the resistance, as in applying a force to the front of a hat from within will pull it in at the sides; and the other effect of pushing at the ground in the concluding stage of the step, being necessarily made with the inside heel, which is found to be the weaker,* de-

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* The following extract is submitted as embodying the received theory of the cause of difference in strength between the inside and outside heels or quarters, viz.:

"While the crust becomes thinner towards both quarters, termines the inflammation from which the corn arises, to that spot where the corn is almost invariably situated, viz., the inside heel (§ 33).

it is more so at the inner quarter than at the outer, because more weight is thrown upon it than upon the outer. It is more under the horse. It is under the inner splint-bone, on which so much more of the weight rests than on the outer; and, being thinner, it is able to expand more. Its elasticity is called more into play, and concussion and injury are avoided. When the expansion of the quarters is prevented by their being nailed to an unbending shoe, the inner quarter suffers most. Corns are oftenest found there; contraction begins there; sand-crack is seated there. Nature meant that this should be the most yielding part, in order to obviate concussion, because on it the weight is principally thrown, and therefore when its power of yielding is taken away it must be the first to suffer." —*The Horse*, by W. Youatt, 2nd Edition, p. 373.

Thus we have duties attributed to an organ to which its structure is unequal, although its unfitness for such duties is proclaimed by the diseases to which that organ is exclusively subject, a theory incompatible with the law that so harmoniously pervades the animal economy, which admittedly provides that the supply should be commensurate with the demand. The true cause of the difference in strength in the heels, and the susceptibility of disease in the inner heel, will be found in our disregard of the proper method of using the animal, by suffering him to go on his shoulders; his hinder feet, which should not alone advance sufficiently far to effectually propel the weight, but also to steady and sustain the trunk, are rarely found to arrive at the point by which that object can be effected; therefore the horse, while in motion, is forced

§ 49. Such are the principal evils of faulty action as developed in the foot of the horse; and where any of these so caused is present, it is obvious that no ingenuity of the shoer can effect a cure; the trainer must restore the animal to the use of his true propellers, before the radical cause of the disease can be reached, or the proper methods of prevention against its return be adopted.

§ 50. In enumerating these evils arising from faulty action, it will be observed, that I have throughout spoken of the foot irrespective of all considerations arising from the presence of a shoe. We have now to consider the foot in its shod condition, and whatever views we are to take of it from this point onwards must be with reference to a rigid rim of iron attached to it round the external margin of its lower surface.

§ 51. This obviously makes a material difference in

to the alternative of principally steadying himself on two legs instead of four, which in order to effect, he is obliged to seek a wider base, and to go on the inside of his fore feet, resembling the movements of a skater. Thus worked contrary to the natural design, the diseases incidental to the inside quarter supervene, and as peculiarities of gait and disorganization are transmitted from one generation to another, we find weakness in the inside quarter perpetuated, and corns not unfrequent in feet which had never been shod.

the question. However the iron may be attached, whether so as to impede, or so as to accommodate the natural action, it is attached round the crust, and it removes the sole from the ground to the extent of the thickness of the iron plate. This, for the ordinary wear and tear of our roads, cannot well be taken as less, on an average, than the third of an inch. Here, then, is a serious interference with the natural arrangements ; and, easily disturbed as we have seen these natural arrangements to be, by causes independent of this interference, we must be sensible of the extreme difficulty of preserving the feet of the shod horse from so many and complicated causes of disease; and we need not be surprised when we consider, that more of the depreciation of value of horse stock arises from their having bad or diseased feet, than from all the other drawbacks to which such property is subject.

§ 52. In the first place, the shoe necessarily transfers a certain amount of the labour which ought to be borne by the sole and frog to the horny crust. All excesses of labour are calculated to produce inflammation, and hence the shoe, which is so contrived as to make the horny crust take up an excessive share of labour from the sole and frog, will be just as efficient in producing *corns*, through the medium of the laminæ irritated by the overstrained horn from *without*, as through the medium of any undue force distributed to the same laminæ by means of the overwrought foot bone from *within;* for these penetrating surfaces, lying between the horn on the outside and the *cutis* which attaches them to the foot bone on the inside, are equally accessible to injury in either direction, and that injury, from whichever side it may arrive, will, by causing inflammation, result in the same symptoms. But the *corn*, by whatever means produced, is greatly aggravated by the iron shoe, when so nailed on as to prohibit the relief that the corn, in an unshod foot, would derive from the expansion of the quarters. An inherent evil, therefore, of the iron shoe, is its undue pressure on the crust. Hence the great severity of road-work as compared with riding on soft ground. In the former, the crust has to bear nearly the whole burden; in the latter the soft surface, rising in the hollow of the foot, distributes the pressure over the sole and frog.

The other diseases which I shall now proceed to trace to the action of the shoe, are attributable, proximately or ultimately, to its being fastened on all round the foot by unyielding attachments, as it has usually been attached, time out of mind, and still continues.

§ 53. And, first, if we suppose such a shoe rigidly fixed to a foot, in which the pasterns are short, and the action inconsiderable, the consequence will not be so severely felt; for, however strictly the rigid iron band may prevent the opening of the parts near the base, for the reception of the spreading cushion pushed down by the small amount of action that goes on inside such a foot, the elasticity of the horny box itself will make a tolerably adequate provision for the necessary movements; so that, on such a foot, the shoe, besides casting an undue burden on the crust—an inherent defect in all shoes hitherto devised—will not produce any immediate ill effect; and, therefore, where we find a naturally short pastern and small action, we generally may count with confidence on a hard and enduring foot, although, for the reasons above-mentioned (§ 44), not on an easy or safe mode of going.

§ 54. But where the rigid iron is fixed, by unyielding attachments, round the base of a foot in which the pastern joints are well developed, and the action of the lower pastern bone free, *then* (and such is the character of nine out of every ten horses' feet) the case becomes widely different.

§ 55. The action must find room for its accommodation; and the base of the foot being nailed up from all power of expansion, the wall of horn sometimes tears at the point where it is thinnest, on the inside quarter, which rent in the horn is *Sandcrack* (§ 35).

§ 56. The frog being no longer of any use, the iron at each side keeping it inert, loses its elastic quality, and becomes dry and chippy: and the sensible frog being opposed to such unnatural contact becomes inflamed, and exudes an acrid humour, constituting *Thrush* (§ 37).

§ 57. The cutis which, all round the foot, is interposed between the external coverings and the internal bony structure, being pressed at various points between the moving masses within and the immoveable plates of hard matter without, becomes inflamed, and not unfrequently eventuates in *Pumiced Feet*, or under the additional excitement of external injury, may run into abscesses discharging purulent matter,—the symptom known as *Quittor* (§ 38).

§ 58. But the great prominent evil of the rigidly attached shoe, and which differs from the foregoing in being not merely occasional, but almost a uniform attendant on the presence of the iron cincture, is *contraction*, accompanied by a greater or less degree of inflammation. The mere inaction of the frog would result in a wasting away of that organ not necessarily attended with inflammatory symptoms of any kind; but when once the frog has ceased to perform its functions, and shrunk into the inert mass of hardened horn which we find in the place of the elastic and India-rubber like gusset set between the heels by nature, the accommodation required for the action of the parts above, cannot be afforded without a painful distention of the upper and middle portions of the horny box; for in this state of things it is plain that the expansive quality of the bottom of the box (§ 21) is destroyed. The consequence is, that the animal either continues to work his pasterns, without sufficient room for their play, and so induces inflammation throughout the body of the foot; or else, as is not unfrequently the case, avoids the immediate cause of his uneasiness, by restricting his pastern action. But this he can only do by going on the toes, and assuming that very attitude of faulty carriage which has been already described, and the results of which, whether produced by an effort of the animal to compensate for the loss of power in his true propellers, or to avoid the inconvenience of carrying on his pastern action without sufficient accommodation for the descending bones, exhibit themselves in precisely the same series of symptoms—the unduly burdened foot bone being in both the medium through which the diseased action is communicated—viz., corns and inflammation, running into navicular disease.

§ 59. It is worth while to observe the analogy between the effects of displacing the centre of gravity, and those of impeding the natural action of the frog and quarters. Both result in the employment of a series of expedients to get rid of the inconveniences arising from this, as from every other departure from the arrangements of nature; and these expedients all come to the same thing in the end, the foot bone, the lowest of the set, and last that either could be expected to affect, constituting the final medium by which they respectively convey their disorganizing influences to the parts most susceptible of inflammation. Thus, with a rigidly attached shoe, it is hardly possible to preserve the animal from faulty carriage; and the better his carriage is, the more likely is the shoe to have that effect; and with faulty carriage it is next to impossible to preserve him from disease. Enlarged action, as I have shewn in my Treatise on Training, is the best preventive of faulty action arising from the imposition of weight in advance of the natural centre of gravity. On the other hand, to find a shoe which will leave the action imparted by the trainer unimpaired, is the problem which I have undertaken to solve in this inquiry, and I now proceed to describe the various shoes which have, from time to time, been devised with this object, among which I candidly expect to shew, that my own lately invented slide-nail shoe is much the most efficacious.

# CHAPTER III.

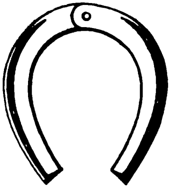
## SHOEING.

The subject of the best means of shoeing has, as its vast importance might justly lead us to expect, been treated of at great length. Many varieties of opinion have been given by numerous writers, and various shoes have been devised, which the inventors have respectively put forward as best calculated to answer this important purpose.

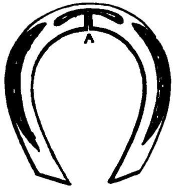
§ 60. Mr. Strickland Freeman's essay may, for all practical purposes, be regarded as the first exposition of the subject which called the attention of shoers to the expansibility of the foot, and induced the contrivance of several ingenious shoes intended to accommodate that action.

§ 61. Of these, the first, invented by Mr. Bracy Clarke, was formed with a joint at the toe, the design being, that it should open out from that joint, as a centre, at each step. But the inventor overlooked the fact, that the expansion of the horse's foot radiates from a centre considerably further back in the sole

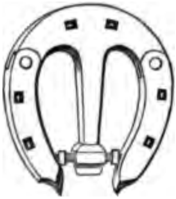
(§ 23), if, indeed, radiation can properly be applied to that divergence of the parts laterally from the line of the frog, which is the truer description of the action to be accommodated. But a much more serious objection, both to this and to the next mentioned shoe (and, indeed, an insurmountable difficulty in the way of any jointed shoe), is, that the weight of the animal presses the shoe immoveably against the ground at the very moment when the expansive action is most urgently demanded. It may be objected that so does the weight impress the natural hoof, and that if the cause be sufficient to counteract the expansion of the one, it ought also to have the same effect on the other. But it must be recollected, that the artificial shoe and the natural sole present very different surfaces; the weight, which in the one is supported by a broad and nearly continuous surface, being, in the other, collected on a narrow projecting rim, which, on surfaces even moderately yielding, penetrates to some depth. Add to this the impossibility of procuring any iron jointed apparatus free from the corrosion of rust in such a situation, and the failure of the jointed shoe will appear no more than might reasonably have been expected.



An ingenious improvement on Mr. Bracy Clarke's pivot-joint is mentioned by Nimrod ("Condition of Hunters," p. 355), as having been recently invented by Mr. Rogers, V. S., of Exeter, and which he describes as "the most likely of any I ever met with to counteract the effects of an inflexible substance nailed to a flexible organ, on which great weight is to be placed." The invention consists in a peculiar slit, as shewn in the margin(A), by which unquestionably a degree of elasticity can be obtained without any risk of corrosion from rust; but still an elasticity *in the wrong direction.*



§ 62. To obviate the objection to the toe joint, that it originated the expansive action from a centre too much in advance, a second jointed shoe was devised, having two joints, one at about a third of the distance from the toe to the heel at either side; this, if it had worked at all, would have given an action even more at variance with the true direction than the former; but the weight of the animal, and the effects of rust arising from necessary exposure to moisture, prevented it having any other effect than the common shoe. To coerce the jointed shoe into action, a method was next adopted of interposing between the heels a



powerful screw, extending over the frog, and pressing the moveable wings of the shoe outward. This addition was singularly misconceived; for it is obvious that its effect was the same, whether the foot was placed on the ground, expanded by superincumbent weight, or whether it was in air, at the moment when, instead of being expanded, it ought properly to be collapsed (§ 41), the small pastern and navicular bones having then risen out of their bed on the elastic cushion, and the frog, which kept the parts open for their reception by contact with the ground, having, at the same moment, resumed its close condition; so that the screw kept open what nature designed to be shut at every step, and must consequently have been a hindrance instead of a help to the animal.

§ 63. The action of the quarters being manifestly neither a circular radiation from a single centre at the toe, nor from two centres at the sides, but a divergence in a curve which could only be approached by radiations from a great number of centres, the next and last adoption of the joint principle was the application of a number of short metal plates to a circle of leather; so as to accommodate the action by a number of movements from independent centres; but the device, however ingenious, was much too complicated, and too liable to derangement, for any purpose of practical utility.

§ 64. The successive failure of these repeated attempts at providing for the expansive action of the foot appears to have deterred shoers from any further attempt in this direction for a considerable time, and Mr. Goodwin having, in A. D. 1820, taken up the subject with a view to perfecting the common shoe, which as yet appeared the only practically available one, and having suggested many valuable improvements, any further advance in the art of shoeing began to be regarded as chimerical.

§ 65. Mr. Goodwin having taken a review of the various modes of forming and attaching the iron defence in different nations, and having selected from amongst them whatever he thought worthy of imitation, arrived at the conclusion that the ordinary shoe bent upward at the toe, and slightly modified in its upper surface, and attached to nearly two-thirds of the entire circumference, was, on the whole, the most serviceable defence capable of being devised.

He fully admitted the defect under which all such shoes must labour, in not providing for the expansion of the foot, and remedied the evil, as far as he could, by nailing around as small a portion of the circumference as would suffice for giving the necessary attachment. In this, so far, he effected a very beneficial change, as well in the diminished number of nails introduced into the horn, as in the comparative freedom in which the heels of horses so shod were left, though no shoe could, by his method of nailing, be at all securely attached without still materially impeding the natural action. In the alteration of the ground surface, also, Mr. Goodwin must be regarded as having introduced a change of much advantage, and one approaching more to the natural form than had hitherto been in use; but in the turn up at the toe the prudence of his system may justly be questioned; and as this style of shoeing has recently been revived, with pretensions as well to singular utility as to originality, I would offer a few observations on the principle propounded by Mr. Goodwin in its adoption. Mr. Goodwin deduces his theory from the following considerations, the first being thus stated: "When a horse is about to move, the first indication of motion in the fore leg is a bend at the knee, which necessarily raises the heels, and the toe (which is the last part that leaves the ground) is lifted for the moment that the foot is suspended. The base of the foot, just as it is leaving the ground, is almost perpendicular when the knee is bent to its fullest extent; the foot is then in the same position, with the heels of the shoe pointing upwards. If we consider this first part of the motion of the limb, we find the movement of the foot very nearly describes a semicircle; and in viewing the form of the joints connected with action, the necessity of a curve at the toe is clearly demonstrated."

"Again, the form of a shoe worn out, at once shews that it must be more suitable to put on a new one of that form, rather than suffer the action of the leg to be opposed until it is worn to that shape."—*Goodwin on Shoeing Horses*, p. 158.

It is true, the shoes of horses going in false action are worn at the toe, just as those of persons who walk inelegantly will be worn at one side; but thus to imitate the result of a defect is to perpetuate, not to remedy, the evil.

It will be found on examination of the true action of the limbs that Mr. Goodwin's description applies only to that condition where the horse goes out of balance, and with depressed forehand is hurried by his impetus in advance of his supports; hence the flexion of the joints of the fore-leg is effected behind instead of before the point of the shoulder, necessarily causing the toe to be the last part of the foot to leave the ground and the first to reach it.

Here it is necessary to draw attention to what constitutes true or perfect action. In the Essay on "The Powers of the Horse," before alluded to, the Author has shewn that the hinder quarters are the propelling agents, and that the fore quarters are what might be termed the supporters of the trunk, the limbs being so constructed as to perform during progression the office of supporting the trunk in equilibrium, and in a horizontal direction. When the animal is in a state of progression, it is therefore necessary that the limbs, performing their proper duties, should arrive at their respective destinations, so as to preserve the desired balance or equilibrium, otherwise the weight of the body is thrown in advance of the limbs, and faulty action supervenes. But when we take into account the influence of the weight of a rider, placed, as it unquestionably is, in advance of the animal's centre of gravity—where due preparation has not been made—

we can have no difficulty in accounting for the number of horses going as Mr. Goodwin describes. There are many persons who suppose that high and attractive action is unnatural and inconvenient to the animal, and that the employment of means to produce such is injudicious. To shew how erroneous are their views, we need only refer them to an examination of the animal in the wild, or as we see it, in its young and unbroken state, when, if excited, he displays that high and independant action which is but too generally mistaken for playfulness. This action is produced through the position in which all his power is concentrated, and is put on only under circumstances requiring the greatest amount of muscular exertion. Now, by carrying our observations farther, it will be seen that there is a principle on which all physical power is essentially dependent, that is respiration, upon the free and uninterrupted exercise of which, not only muscular energy, but life itself, depends.

The association of duty and harmony of operation observable in nature's works, is no where more evident than in the mutual action of the muscles of respiration and those of progression, for it will be found that many of the muscles engaged, simultaneously assist each other, and are tributary to the double duty, aiding in progression and respiration at the same time. Now at periods requiring the greatest amount of exertion, the position of the frame that allows to the muscles the fullest amount of action and effective co-operation must be esteemed of no little import: this we can easily shew to be that in which the horse moves with his forehand elevated and shoulders thrown back ; the expansion of the walls of the respiratory cavity is not only not interfered with, but promoted to the fullest extent, the due performance of the functions of the lungs provided for, and by the increase of surface thus admitted for the muscles which move the limbs to act from, as well as the fulcrum from which their power eminates, being properly sustained, mechanical advantage is proportionably increased. Therefore may it be shewn on rational grounds, if the testimony of experience were wanting to prove the position, that the horse should be taught to move consistently with those arrangements, by which his natural power would be uninterfered with, his durability secured, and the wear and tear from concussion best avoided.

The performance of the American Trotters fully attest the correctness of the foregoing views, by shewing that the animal's power and endurance are associated with proper carriage, many of them having made their best performance from fifteen to twenty years old. To make the shortest time (they measure the speed by this rule) the horse must go in balance, or move so as to carry his spine horizontally, which he can do only by elevating his forehand, or, as it is called, getting his fore-legs out of the way. This position is necessarily induced by the amount of restraint required to prevent the horse breaking his trot when going at his best pace; and it is well understood that the success of the horse depends on the untiring support of the rider or driver at such a crisis. This position, therefore, in course of time becomes the habitual carriage of the animal.* Here, then, we have the position favourable to respiration and progression uninterfered with and its results, improved action and muscular development. The limbs of those horses, from being worked in unison, rarely exhibit symptoms of wear and tear: the feet, however, are not unfrequently affected with chronic contraction and corns (§ 44); and, from being worked, as they almost invariably are, on the trotting course and soft roads of that country, this state of the feet could not exist except through a defective mode of shoeing.

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* It is to be regretted that these results are as little observed in the trotting country as they are elsewhere.

A skilful musician cannot with more facility detect an instrument out of tune than an experienced horseman can discover the want of harmony in the action of a horse moving out of balance; but even those who are not *au fait* on the subject, by observing and comparing the mode of action of two horses, one going in balance, and the other out of it, cannot fail to be impressed with the superiority of the one condition over the other.

In faulty action, or, as it is called, going on his shoulders, the horse cannot advance either fore or hind legs to their destination, so that the bending of the joints takes place at an improper time, and consequently is imperfectly performed.

In the best trot of such an animal, when a great amount of flexion is required, the action of the hinder leg may be observed following with the point of the hock jerked as if backward and elevated, opposing, as it were, an antagonistic movement to the advancement of the limb, so that it is brought forward, or rather drawn after the body in a manner resembling the movement of a stilt, consequently not arriving near to its proper destination.

The fore leg, the progress of which depends on the advance of the hinder one, moves with little or no elevation at the knee, causing the flexion of the limb to take place as far behind its true position as the hind foot falls short of its proper situation. But in perfect action the movement is otherwise; the hind leg is flexed and advanced by a combination of muscular action, the extent of which may be calculated by the elevation and advancement of the point of the *Femur* or Stifle; thus the limb comes forward under the centre of gravity in a high state of contraction, the opening out of which shoots the body forward in the ratio of the angles formed. The limbs coming to the ground in the manner stated, necessarily takes from their ordinary height, leaving the superiority of altitude in favour of the forehand.

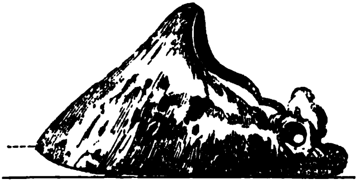
The forehand in consequence is elevated, and being sustained by the successive advance of the hind legs, necessarily produces that obliquity in the shoulder, which, while it increases the mechanical power of the muscles of progression, insures to the chest that expansion which is indispensable to the freedom of respiration. The index to the extent of action in the fore-leg may be sought for in the *Radius* or arm, it being the only perceptible moving agent in the limb,

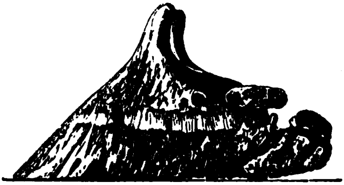
and which, owing to its articulation with the *Humer*
is competent to raise the knee nearly parallel with
line of the body.

The flexion of the knee is therefore performed b
the elevation of the *Radius* through the agency of *its* powerful muscles; which movement is accompanied by the flexion of the pastern now raising the foot while yet in advance of the point of the shoulder: the foot extensors here come into action and perform their duty, by carrying the foot forward in advance of the knee; thus the limb, at each successive step, comes to the ground with the necessary obliquity in the pastern, which, while it insures the proper position of the foot when in contact with the ground, brings into requisition the springs which are designed to prevent concussion.

Here it may be remarked that the shoes worn in such action do not exhibit the appearance noticed by Mr. Goodwin, but present a uniform surface.

Mr. Goodwin's next ground is the alleged fact, in which he follows Mr. Bracy Clarke, that the foot-bone itself actually has this peculiar shape; and in his frontispiece he gives a drawing of such a foot-bone, which is represented resting on the middle of the sole and heels, while the toe rises in front with a marked curve, as shewn in the subjoined cut. I take it for granted that so respectable a writer has not misrepresented the foot-bone from which his drawing was taken; but if so, the bone must have been deformed; for I can say, from an inspection of very numerous foot-bones, that such is not the usual or natural form of that part of the healthy foot, but that, on the contrary, the toe projects in exactly the same plane with the base of the bone, the only difference of level round the rim of the bone being at the wings, which slope gradually upward, as shewn below, being exactly the reverse of the figure represented by Mr. Goodwin.





That the natural growth of the horn is conformable to the latter disposition of the bone Mr. Goodwin himself admits, but insists that it is an overgrowth, which the shoer ought to pare away in applying the turned-up shoe. Now it follows that if Mr. Goodwin be wrong (as unquestionably he is) in his idea that the foot-bone curves upward at the toe, the process of cutting away the horn at that point, to make it conformable to the supposed shape of the internal parts is an error, inasmuch as the sensitive laminæ surrounding the foot-bone there, receive the principal force of the impetus every time the foot comes to the ground; their depth, too, from the coronet to the toe, as compared with those on any other part of the foot, plainly indicate the duty imposed on them, and consequently require a thicker and stronger defence there than any where else ; but the paring away necessary to make room for the toe of Mr. Goodwin's shoe removes the exterior crust just at this point where its interposition is most required; so that if the shoe be put on with any considerable elevation in front, the removal of the horn at the toe cannot but seriously weaken the supports of the foot-bone, and expose the whole front of the foot to violence and inflammation.

§ 66. In this condition was the art of shoeing, when in 1830 Mr. Turner, the ingenious veterinary surgeon, of Regent-street, London, devised and applied the important principle of allowing the foot to expand *on* the shoe instead of *with* it. Like most of the principal additions to the useful arts, Mr. Turner's discovery was the result of observation. He took notice that on shoeing a horse he had under treatment for brushing his fore-legs, which had been shod with the ordinary interfering shoes, nailed on the outside only, that the hoof on the inside had expanded considerably beyond the margin of the shoe; a result which naturally followed its release from the restraint of the nails. Acting on this principle, Mr. Turner found that the shoe, nailed on through one-half, or little more than one-half, of its circumference, might be applied to feet in the ordinary state of health, with comparative security, and with decidedly beneficial results to the foot, one-half, or nearly one-half of which, was thus left free to move in and out, as nature designed it should do, slipping on the unattached surface of the shoe, instead of being, as formerly, pinned to it by unyielding attachments.

§ 67. Mr. Turner has illustrated the advantages of this principle, and the merits of his unilateral, or one-side nailed shoe, in an interesting Essay, in which, having expounded the expansive and contractile motion of the hoof, he declares—an opinion in which no veterinary surgeon of the present day can refuse to concur—that "If in shoeing there is to be found the necessary defence for the foot, without having the natural expansion of the hoof impeded or restrained by the ring of iron nailed thereon—or, in other words, which will admit of all the functions of the foot being duly performed—I will venture to pronounce it the horseman's grand desideratum."—*Turner on the Foot of the Horse*, p. 50.

§ 68. To the extent, therefore, of one-half of the circumference of the sole, Mr. Turner has the credit of achieving what he justly describes as "the emancipation of the foot from the iron fetter;" and his invention has justly been regarded as a near approach to the perfect model, and is spoken of in the latest and most authentic work on the Horse in terms of high commendation, which I extract, as furnishing not only a just tribute to the ingenuity of its inventor, but also a striking enumeration of the evils which the principle of expansion is caculated to obviate and remedy. "For a material improvement in the art of shoeing we are indebted to Mr. Turner of Regent-street. What was the state of the foot of the horse a few years ago? An unyielding *iron hoof* was attached to it by four nails on each quarter, and the consequence was, that in nine cases out of ten the foot underwent a very considerable alteration in its form and in its usefulness. Before it had attained its full development—before the animal was five years old—there was, in a great many cases, an evident contraction in the hoof; there was an alteration in the manner of going; the step was shortened; the sole was hollowed; the frog was diseased; the general elasticity of the foot was destroyed; there was a disorganization of the whole horny cavity, and the value of the horse was materially diminished. What was the grand cause of this? It was the restraint of the shoe; the firm attachment of it to the foot by nails in each quarter, and the consequent strain to which the quarters, and every part of the foot, were exposed, produced a necessary tendency to contraction, from which sprang almost all the maladies to which the foot of the horse is subject.

"The unilateral shoe has this great advantage: it is identified with the grand principle of the expansibility of the horse's foot, and of removing and preventing the worst ailments to which the foot of the horse is liable. It can be truly stated of this shoe, that while it affords to the whole organ an iron defence equal to the common shoe, it permits, what the common shoe never did or can do, the perfect liberty of the foot."—*The Horse, by* WILLIAM YOUATT, *published by the Society for the Diffusion of Useful Knowledge*, 2nd Ed., p. 424.

§ 69. Such, then, was the state of this useful art, when, in 1843, the author of the present Essay directed his attention to the subject; and at once recognized the manifest superiority of the unilateral shoe, in principle, to all the others. But, in the details of its construction, it had these great and palpable defects. It was insecure, being attached only through a portion of its circumference, and very liable to be wrenched off in over-reaching. Besides, it accommodated the natural action of one side of the foot only, and kept the other even more strictly bound than ever, owing to the necessity of having the nails farther back, and closer at the side attached, while the other side remained free. It therefore appeared to the Author, that to effect the desired object, he should make a shoe which would be as secure as the common one, and, at the same time, afford room for the natural action *to both sides of the foot.*

§ 70. This object the author believes he has fully attained in his new Patent Shoe, which he now submits to the attention of his readers, as providing all that, from the whole of the foregoing considerations, can be desired or expected in a perfect horse-shoe, and to which, he humbly conceives, the veterinary scientific world can hardly refuse the title claimed for Mr. Turner's, of "the horseman's grand desideratum." Nothing can be more simple than the means by which this result has been obtained. The elastic action being confined to the region of the heels and quarters (§ 41), the whole front of the foot offers a line of attachment of the ordinary kind; and in the six holes* which are pierced in that part of the shoe, nails of the ordinary counter-sink kind are introduced, and clenched in the usual manner. The peculiarity of the invention consists in the provision made for action behind these points; and this is effected by the simple expedient of having the hinder nail-holes *widened* in the direction of the elastic action to about treble the size that is necessary for receiving the neck of the nail. The nails inserted in these slits or apertures, as shewn in the annexed cut, the Author has termed "slide nails," and their heads take hold of the shoe at each side of these apertures respectively, in counter-sinkings, where they work to and fro, with the alternate expansion and contraction of the hoof in which they are fixed, and at the same time hold the shoe tight to the foot. In this way, at every step of the animal, the natural action takes place; and although the extent through which it ranges in any case is very small, not exceeding the sixth or eighth of an inch at either side, yet the beneficial effects of avoiding an interference with the provisions of nature, even to that slight extent, are most striking and indubitable.

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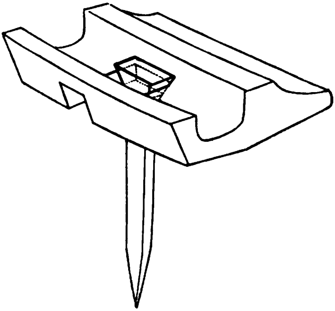
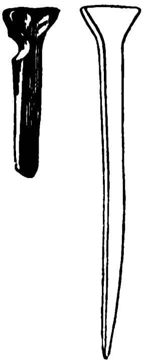
* As few as four nails in strong hoofs are often found sufficient; and would be so in all cases, if riveted according to the Author's original design.

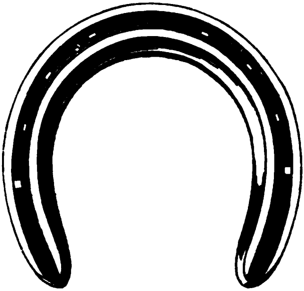


To guard against the effects of gravel or road-stuff lodging in the apertures, an opening is made on the exterior face of the shoe, as shewn in the foregoing cut, through which the action of the nail (carried in and out by the motion of the hoof in which it is fixed) expels any foreign substance that may happen to be taken up.

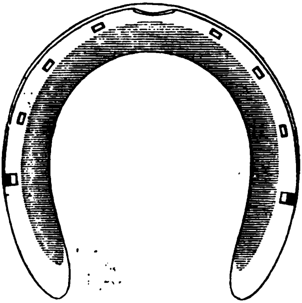


A proof of the accommodation thus rendered to the demands of the foot, is explained by the cut in the margin, which represents a new slide nail, and one that had been in use; the latter marked by wear from friction, caused by the alternate expansion and contraction of the hoof. This nail, worn at one side, has been selected as not only proving the necessity of providing for the action alluded to, but also that the action has taken place under unfavourable circumstances; for the groove in which the nail moved did not accord with the line in which the hoof expanded, thus furnishing incontestable proof that the hoof will expand, if not *absolutely* prevented by fixed nails.

§ 71. All forms of shoe can be applied in this manner with equal facility; but that which the Author has adopted, after many trials, being, in all respects, the most serviceable and convenient, and competent to every modification which the condition of the foot may require, is a shoe having its ground surface widely and deeply fullered or grooved, and caving inwards, as shewn below, so as to give its natural prehensile action to the foot, which greatly conduces to security and steadiness on slippery surfaces.



The foot surface is also represented, being both seated and concave.*



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* The seating in the engraving is made to appear rather wider than it should have been.

§ 72. The patent shoe has now had more than two years' trial, and experience has shewn, in numberless instances, its perfect efficiency in restoring diseased hoofs to health, and giving new vigour to the action of even the healthiest feet shod on the old system. The Author begs to submit, from a great number of communications to the same effect, an Appendix of Testimonials to the efficiency of the Patent Shoe, trusting that the importance of the subject to the owners of horses will justify the full manner in which it has been investigated.

# TESTIMONIALS.

### *From* RICHARD CARMICHAEL, ESQ., &c. &c.

" *Rutland-square, Oct.* 27, 1846.

"DEAR SIR,—I feel great pleasure in stating my opinion respecting your improvement in the mode of shoeing horses, and it is this, that the shoe you have invented, while it affords ample protection to the horny hoof, permits the expansion of the entire hoof while the animal is in motion; thus effecting an object of the greatest moment in preventing many diseases of the sensible hoof, but more particularly corns, which are occasioned by the impossibility of the expansive power of the hoof, during exercise, when the horse is shod in the old usual way.

" The advantages of your invention are obvious to any person who considers the form of your shoes, but I have had experience to convince me of its superiority over the old method.

"I am, dear Sir, your's faithfully,

" RICHARD CARMICHAEL.

" *To Mr. Clarendon.*"

### *From* JAMES CUSACK, ESQ., M. D., &c. &c.

"3, *Kildare-street, May* 26, 1846.

"DEAR SIR,—I have now had two years' trial of your system of horse-shoeing, and can with pleasure bear testimony to the very great improvement for which the public are indebted to you. I think there can be no doubt whatever but that your shoe must tend in a great measure to preserve the foot from contusions, which the animal must be necessarily liable to, particularly in the streets of a city; but the greatest improvement which I can perceive in it is the power which is given for the expansion of the foot, all fear of contraction being thereby removed.

"J. W. CUSACK.

"*To T. Clarendon, Esq. &c.,*
*Great Brunswick-st.*"

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### *From* JOHN PEEBLES, ESQ., M. D., &c. &c.

"26, *Dorset-street, July* 2, 1846.

"DEAR SIR,—I received your queries on the subject of my horses' feet, and my past two years' experience in your method of treating them.

"My working pair of horses wear out a set of patent shoes each every month, and go fast over roads and pavement several hours daily without wincing, although one horse is twenty years old, and had, for many years, corns, thrushes, contracted heels, and crippled action, in the hands of the most expensive smiths. Your forge and the men employed therein enable you to carry out your system, and give satisfaction to horse proprietors such as other superintendents elsewhere would not or could not give. You had not inflammation to contend with in the feet of these horses: they were fit for fast work; you had only to restore the natural cup formation, give frog pressure, and permit free expansion and contraction of the heels; and this has been well done.

"Your's faithfully,

"John Peebles, M. D.

"*Mr. Clarendon.*"

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### *From* J. K. Forrest, Esq., F. R. C. S. I.

"*Great Brunswick-street, Dec.* 1, 1846.

"Sir,—Early in the year 1844 I very willingly expressed my testimony as to your contrivance, the patent horse-shoe, and now, in answer to your inquiry as to my opinion on the subject, after further experience and observance of its utility, I have no hesitation in again recording my views as to its eligibility for general use, and superiority on principle over the mode of shoeing ordinarily adopted.

"I feel impressed with a belief, from the horny structure of the hoof, with its walls separated behind, and the state of the frog and sole in their connexion, that there here exists a condition which allows a variation in the form of the case as pressure may be exercised upon its contents; in other words, that an expansive action is admitted in its sides posteriorly. In this way would there be a provision made for the descent of the navicular and lesser pastern bone, when increased impulse is communicated to these parts. Now, as this would furnish a spring-like capability, well calculated to diminish the effects of shocks, and as it would be of immense advantage in this part of an animal destined for such uses as the horse is, I feel that I cannot laud too highly that provident arrangement of your's which, while it preserves the permanent connexion of the shoe to the foot, as a defensive apparatus, at the same time, by the contrivance of the sliding grooves in the shoe for the shanks of the nails, permits that yielding motion in the walls of the hoof which is tributary to its healthy and most useful action.

When I last wrote to you my experience of the services rendered by the shoe, to a horse then in my possession, whose heels were contracted, and whose gait had become affected, made me very readily give my assurance of the advantage of your system. Since then, however, having tested its utility with other horses, the evidence of its service has been so manifest in my eyes, that I resort to the use of your shoe entirely, and I now gladly avail myself of the opportunity which your inquiry affords me, to bear testimony once more, and with renewed confidence, to the merit which attaches to your invention.

"I am, dear Sir, very obediently your's,

"J. K. Forrest."

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### *From* Sir Gilbert King, Bart., &c. &c.

"1, *Kildare-place, Dublin, May* 18, 1846.

"Dear Sir,—Having had considerable trial of your system of treating the feet of horses in preparing them for the shoe, I believe you adopt the true principles for preventing contraction, unnecessary concussion, and consequent lameness; but in your patent shoe, which perfectly provides for the expansion of the foot, so necessary to take place at every step of the animal, you have successfully overcome the great, and hitherto insurmountable evil, attending the shoeing of horses.

In my opinion, your patent shoe far excels every other shoe that is known.

"I remain, dear Sir, your's truly,

"Gilbert King, Bart.

"*Mr. Thomas Clarendon.*"

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## *From* The O'More.

"*United Service Club, December* 4, 1845.

"Sir,—In reply to your letter, in which you expressed a wish that I should give you my opinion of your patent shoes, I must say that, having had my horses shod with them now for some time, I consider them most useful. However, not to enter into a lengthened detail of the merits, I will only add that, having used them with one of my horses who had very narrow and contracted feet, they materially improved his action.

"I beg to remain your's very faithfully,

"Garrett O'More."

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## *From* The Right Hon. Thomas F. Kennedy, &c. &c.

"*Treasury Chambers, Dublin Castle,*
"*February* 6, 1846.

"Sir,—Having had experience of your peculiar system of shoeing horses for nearly two years, I think it only due to you to say that I have derived great benefit from it. In one case the fore-feet were rapidly becoming contracted and bad, and I have no doubt that the horse to which I refer would by this time have been almost unfit for use. Your patent shoe has restored his feet, which are now strong and good.

"Experience, therefore, satisfies me that your system will preserve good feet, and tend very much to restore feet which have been injured by bad shoeing.

"I am, Sir, your very obedient Servant,

"T. F. KENNEDY.

"*To Mr. Clarendon, Brunswick-street, Dublin.*"

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### *From* MARK ANTONY SAURIN, ESQ.

"*Carysfort House, Blackrock, July* 22.

"MR. CLARENDON,—I feel great pleasure in bearing my testimony to the merits and beneficial effects of your new mode of shoeing horses, which I have had now (as you know) some experience of. It has been of the greatest service to one of my horses in particular (the large Yorkshire horse), whose feet certainly have been greatly improved by it, and the horse in consequence rendered much more serviceable to me than he had been for a long time past, before I put him under your care.

"I remain your's truly and obedient, &c.,

"MARK A. SAURIN.

"P. S.—I should also mention for your satisfaction that another horse of mine, which had bad corns before I adopted your new mode of shoeing, has been nearly quite cured of them, which I attribute to your management of his feet."

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### *From* WILLIAM R. LA TOUCHE, ESQ.

"*Bellview, Delgany, May* 25, 1846.

"SIR,—As you desire to have my humble testimony to the efficiency of your invention, I have much pleasure in saying, that, during an eighteen months' trial of your patent shoes, I have found horses invariably benefited by their adoption, where tenderness of the feet existed; their general condition, as well as action, being materially improved by the ease given to their feet by your method of shoeing.

"I am, Sir, your obedient,

"William R. La Touche."

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### *From* Robert Bramston Smith, Esq.

"*Upper Fitzwilliam-street, May* 20, 1846.

"Dear Sir,—In reply to your note, desiring to have my opinion of your system of shoeing horses, I have to say, that, so far as I can judge, it excels all others, whether it be considered with reference to the comfort and consequent value of the horse, or the safety of the rider.

"Two hunters of mine, at different periods, unaccountably and apparently incurably lame in the fore-feet, became, and remained perfectly sound, by the use of your shoes, unaided by rest or any other remedy.

"I have found the patent shoes of great advantage on streets partially watered, or rendered slippy by any cause, the peculiarity of their surface giving the horse a hold of the ground which could not, of course, be expected from the smooth shoe in common use.

"This alone, their least recommendation, ought to insure the adoption of the patent shoes by all who ride much on the streets or roads, and like to be carried safely.

"Wishing you all the success you so well merit,

"I remain, dear Sir, your obedient Servant,

"Robert Bramston Smith."

### *From* ROBERT M'MAHON, ESQ.

"*Tacarry House, Omagh, July* 2, 1846.

"MY DEAR SIR,—In answer to your note about your patent shoes, I have not the least hesitation in stating that, in my opinion, which, I am afraid is of only very little consequence, they are unquestionably the best of any we are acquainted with; as, while they permit all the functions of the foot being performed as in a state of nature, which the common shoes do not allow, they at the same time give all the protection necessary to the foot as completely as the common shoes.

"They are also of the greatest use in giving a firm foothold to the horse in slippery places, owing to their surface being grooved.

"Nothing can afford a more convincing proof of my idea of their manifest superiority to every other shoe, than that, after trying them in Dublin for some months, I sent a smith all the way from this part of the country to you, to be instructed in your mode of shoeing, and in making your patent shoes. I have now been using these shoes on all my horses constantly, and without any exception, for close upon two years, and find their feet increased in diameter, and greatly improved in every respect.

"I must add, that the trial I have already had only tends to strengthen my former conviction of their being very much the most superior shoes (for all purposes, and considered in every point of view) that have ever yet been invented.

"I am, dear Sir, your obedient Servant,

"ROBERT M'MAHON."

### *From* THOMAS BALL, ESQ.

" 85, *Stephen's-green, July* 20, 1846.

" SIR,—I have no hesitation in expressing my favourable opinion of your patent horse-shoe. A mare of mine received the greatest benefit from its use last year. Not only in cases where there is a tendency to contraction, but generally, for promoting a healthy and natural action of the horse's foot, I consider it a most valuable invention.

" Your's, &c. &c.,

" THOMAS BALL.

" *Mr. Clarendon, Brunswick-street.*"

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### *From* JAMES KING, ESQ.

" 24, *Merrion-square, West, May* 2, 1846.

" SIR,—In reply to your note, in which you request my opinion respecting your patent shoe, I have no hesitation in stating that they have been of the utmost service in improving the feet and action of a mare which had been going 'tender,' previously to my trial of your shoes. Since that period, now more than two years, she has been in constant work on the road and with hounds, and her action at present retains all the spring of a horse that had never been shod.

" I am, &c. &c.,

" JAMES KING."

### *From* WILLIAM O'HARA, ESQ.

"9, *Upper Merrion-street, April* 22, 1846.

"MY DEAR MR. CLARENDON,—I do not feel sufficiently conversant with the scientific department to which the subject of your improvement in shoeing horses belongs, to offer an opinion, further than that it appears to me founded upon the clearest and most simple principle. I can, however, speak with perfect confidence, from the experience of nearly two years, of its practical results upon my saddle and draught horses; it having established perfect healthiness and soundness, and produced immensely increased safety of action.

"I am your's very truly,

"WILLIAM O'HARA."

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### *From* GEORGE JAMES BALDWIN, ESQ.

"2, *Anne-street, Circular Road, Feb.* 13, 1846.

"SIR,—I unhesitatingly give you my opinion on your new principle of shoeing horses, which I have been using for the last twelve months, with the greatest advantage.

"The case to which I would most particularly refer is that of a grey mare, which, previously to being shod with your patent shoes, had her fore-feet greatly turned out, and the hoof long and deformed, which caused her to brush; her feet are now in the healthiest form, with greatly improved action, without brushing.

"I remain, &c.

"GEORGE JAMES BALDWIN.

"*To Mr. Clarendon.*"

### *From* JOHN L. O'FERRALL, ESQ.

"*Lower Castle Yard, December* 28, 1846.

"SIR,—In answer to your note I beg to say that the large bay horse has derived much benefit from your improved method of shoeing. I sent him to your forge owing to a tenderness in his fore feet, but with your shoes he very soon became sound, and has continued so for more than two years.

"I am, Sir, your obedient Servant,

"JOHN L. O'FERRALL."

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### *From* CHARLES MILLER, ESQ.

"*Troitskoe, Donnybrook, July* 14, 1846.

"DEAR SIR,—It is now two years since you commenced to shoe my horses, and I can now with confidence state that I consider your shoe superior to any I ever used before. It has had the effect of expanding the heel, and of generally strengthening the foot of the horse. In fact I cannot conceive how any person bestowing a moment's reflection on the subject does not see the value of your shoe. I am convinced that it has the effect of giving to the horse a great freedom of action, and as the sliding nail allows the foot to exercise its natural property of expansion, it is obvious that it must contribute in a great degree to the ease and comfort of the animal when travelling.

"Your faithful Servant,

"CHARLES MILLER.

"*Mr. Clarendon.*"

### *From* JOHN READ, ESQ,

"*Churchtown, February* 19, 1846.

"SIR,—I believe your method of shoeing horses to be superior to any other I have yet seen, and one from which the evil effects so frequently consequent on tight shoeing are least likely to ensue. A horse of mine first grew tender, and then quite lame, on one of his fore feet, but after being shod by your patent shoes, that lameness has disappeared.

"JOHN READ."

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### *From* R. P. TIGHE, ESQ.

"20, *Middle Gardiner-st.*, *Oct.* 4, 1846.

"DEAR SIR,—In reply to your note making inquiry concerning my opinion of your patent horse shoes, I have to observe that from the effects that have been produced by the use of them, for more than two years, on my horses, I consider the invention well calculated to carry out the object intended; and I am satisfied that by careful attention to your plan of shoeing, the growth of the horse's foot will be encouraged, being an advantage so evident, with regard to that useful animal, that it requires no comment.

"Your's sincerely,

"R. P. TIGHE.

"*Thomas Clarendon, Esq.*"

## *From* ROBERT RUSKELL, ESQ.

"*December* 28, 1846.

"DEAR SIR,—I have to acknowledge the receipt of your letter requesting my opinion of your system of shoeing horses. In reply, I have much pleasure in stating my unqualified approval of the utility of your patent shoes, the principle of which seems as simple as it is efficacious. I have now had more than two years' experience of their advantages on different kinds of feet, and have noticed their superiority over the ordinary shoes.

"The accommodation which your shoe renders to the action of the foot was strikingly marked in the case of my favourite hunter, "Smike." This horse had been very tender in his fore feet, but now shows, by improved performance, the absence of all restraint in the shoe. I should not omit noticing an obvious advantage in the construction of the ground surface of the shoe, which, while it prevents slipping, must insure a confidence in the step of the horse, rendering him less liable to stumbling.

"Faithfully your's,

"ROBERT RUSKELL."

THE END.